NORTHERN GOSHAWK HABITAT ANALYSIS AND RISK ASSESSMENT METHODOLOGY

California Department of Fish and Game
Northern California – North Coast Region
Interior Timberland Planning

August 2002

Overview

During the spring of 2002 Interior Timberland Planning staff prepared a Geographical Information Systems (GIS) analysis of habitat conditions in the ¼ mile (e.g., 125-acre) areas around 117 northern goshawk (*Accipiter gentilis*) nests in northern California (i.e., Lassen, Modoc, Shasta, Siskiyou, Tehama and Trinity counties). The analysis was stratified into three Jepson ecoregions (see Figure 1) that cover the interior forested portions of the Northern California – North Coast Region (NCNCR) of the Department of Fish and Game (DFG). The methodology and findings of the analysis are outlined in this document. Although there are some uncertainties that qualify the analysis (e.g., the reliability of the 1994 Landsat satellite acquired habitat data), it represents the best information presently available to the DFG. The purpose of the analysis is to help assess risk of habitat modification to goshawk nesting habitat from timber harvesting projects. However, seasonal operating restrictions for reducing disturbance during the reproductive season may also be advised independent of the habitat risk assessment. The risk assessment methodology discussed below is interim in scope, and we intend to revise or replace it as more information and other analyses become available. We encourage all those involved in the timber harvest review process to provide feedback on this document. If you have questions or comments in regard to this document, please contact Environmental Scientist Brett Furnas by telephone at (530) 225-3221, by electronic mail at bfurnas@dfg.ca.gov, or by post at California Department of Fish and Game, 601 Locust Street, Redding, California 96001. For additional information on DFG policy in regard to goshawk, please look at the Northern Goshawk Review Module and the Northern Goshawk Planning Module.

Risk Assessment Methodology Based on the Analysis

When consulting in regard to goshawk nests and timber harvesting activities, DFG staff will use GIS and the 1994 Landsat imagery to calculate percent area values around the consultation nests for the four habitat metrics shown in Table 1 below. As appropriate, we will adjust these values to reflect post harvest conditions and the effects of changes that may have occurred between 1994 and the present. We will also gauge the accuracy of the Landsat imagery around consultation nests by comparing the data with aerial photography and on-the-ground conditions.

We will use the findings of the analysis (see Table 5) to sort timber harvesting activities that occur around consultation nests into three broad categories of risk for habitat

modification (see Table 1 below). If post-harvest conditions in the 125 acres around a nest remain above 50th percentile conditions from the analysis, we will generally rank the risk level as low and consequently consider the importance of habitat protection measures beyond 500 feet from known nests to be low. If post harvest conditions in the 125 acres around a nest are between 25th and 50th percentile conditions from the analysis we will generally rank the risk level as medium and consequently consider the importance of habitat protection measures beyond 500 feet from the nest to be medium. Additionally, in cases where DFG recommendations for protection measures are not accepted by the THP submitter and CDF, we would consider the importance of post harvest monitoring of nest re-occupancy and reproductive success to be high. If post harvest conditions in the 125 acres around a nest fall below 25th percentile conditions from the analysis, we will generally rank the risk level as high and consequently consider the importance of habitat protection measures beyond 500 feet from the nest and post harvest monitoring to be high. The DFG may also assess risk in terms of the amount of overstory removal proposed within the ¼ mile area around a nest, and the number of alternate nests whose locations are known (see Table 1 below).

Table 1: Goshawk Habitat Modification Risk Thresholds

	Risk Level		
Post Harvest Habitat Metric For ¼ -Mile Area Around Nest	**High**	**Medium**	**Low**
Northwest Ecoregion			
% area 4M+	< 57	57 – 73	> 73
% area 4D+	< 16	16 – 36	> 36
% area 5M+	< 21	21 – 35	> 35
% area 5D+	< 9	9 – 17	> 17
Cascade Ecoregion			
% area 4M+	< 51	51 – 65	> 65
% area 4D+	< 33	33 – 45	> 45
% area 5M+	< 8	8 – 14	> 14
% area 5D+	< 3	3 – 8	> 8
Modoc Ecoregion			
% area 4M+	< 16	16 – 26	> 26
% area 4D+	> 15	15 – 22	> 22
% area 5M+	n/a	n/a	n/a
% area 5D+	n/a	n/a	n/a
All Ecoregions			
% area overstory removal silviculture	> 50	25 – 50	< 25
total # of alternate nests accounted for	1	2	3 or more

Notes:
% area denotes the percent area of the ¼ mile/125-acre circular areas around goshawk nests that are covered by one of four habitat categories (e.g., 4M+, 4D+, 5M+, 5D+). These metrics are based on the California Wildlife Habitat Relationships System (WHR) and were classified using 1994 Landsat imagery for northern California. The scale of habitat classification is 30 meter by 30 meter grid cells within the assessment circles (see Figure 3).

4M+ denotes forested habitat with a quadratic mean diameter greater than 11 inches and canopy closure greater than 40 percent. **4D+** denotes forested habitat with a quadratic mean diameter greater than 11 inches and canopy closure greater than 60 percent. **5M+** denotes forested habitat with a quadratic mean diameter greater than 24 inches and canopy closure greater than 40 percent. **5D+** denotes forested habitat with a quadratic mean diameter greater than 24 inches and canopy closure greater than 60 percent.

Summary of Preliminary Technical Findings of the Analysis

- The distributions of WHR group values within 125 acre buffers (e.g., % 4M+, %4D+, %5M+, %5D+) around nests that meet minimum activity criteria vary between the Northwestern California, Cascade and Modoc eco-regions. In general, westside nest buffers contain more 4M+, 4D+, 5M+, and 5D+.

- However, the shapes of these distributions also vary by eco-region and WHR group (e.g., some are normal, some are bimodal, some are one-tailed).

- In general, the differences in the distributions of WHR group values for nest buffers versus all three sets of contrast buffers are statistically significant. One exception to this finding is for the amount of 5M+ and 5D+ in the Modoc eco-region. A second exception is for the amount of 4M+ in the Northwest buffers versus the closest set of contrast buffers, suggesting that the significant scale for 4M+ might be larger than 125 acres in this eco-region, or that 4M+ is not a limiting factor here.

- Differences in the WHR group values distributions for two sets of inclusion criteria (e.g., minimum nest activity criterion versus no criterion for activity status) are not statistically significant.

Some Limitations of the Analysis

- Some of the location points provided by the NCal-gos database may be linked to occupancy data provided for alternate nests for which location points are not provided. It is possible that the assessment of inclusion criteria for a particular nest location point could be made using occupancy data from an alterative nest located elsewhere.

- The accuracy of the 1994 Landsat modified WHR data is limited. However, accuracy for size classes 4 and 5 and canopy classes M and D is better than for the smaller, sparser classes. To some extent, the grouping of conifer classes may address the relatively small size (e.g., 540 pixels) of the 125-acres buffers (see Figure 3).

- The analysis assumes 125 acres to be the significant scale for habitat around nest sites. Larger or smaller scales may be appropriate for the different ecoregions.

- T-tests were conducted to compare non-normal distributions. However, relatively large sample sizes and the pairing of nest buffers with contrast buffers mitigates this problem and increases the power of the analysis.

Analysis Methodology

1. Used UTM fields in Ncal-Gos (Woodbridge 2002) goshawk database to create a nest location GIS layer (see Table 2 below).

2. Used nest activity fields in Ncal-Gos database to identify nests that were "active" at least 2 years during any four year stretch between 1989 and 1999 (e.g., Woodbridge codes 1Y, 2Y, 3Y, 4Y, A, OAU, ONB, ONB1, ONB2, ONB3 or OU- see Table 6). Removed nest locations points that do not meet this criterion (see Table 2 below).

3. Removed nest location points that are not in Lassen, Modoc, Shasta, Siskiyou, Tehama or Trinity counties (see Table 2 below).

Table 2: Selection of Nest Location Points For the GIS Habitat Analysis

	# of Nest Locations Remaining (by Jepson Eco-region Stratum)			
	All	Northwest	Cascades	Modoc
All nest location points from Woodbridge Database:	490			
Remove nest location points with UTM data problems:	483			
Remove nest location points outside of Lassen, Modoc, Shasta, Siskiyou, Tehama and Trinity counties:	384			
Limited to nest location points that meet "activity" criteria (e.g., active 2 out of 4 years between 1989 & 1999):	160			
Stratified nest location points by Jepson Eco-region	160	29	60	71
Removed Warner Range nest location points from Modoc stratum:	135	29	60	46
Removed nest location points for which comparison of 1990 & 1998 SPOT imagery suggests significant adjacent habitat modification occurred during the 4-year activity criterion period:	117	26	55	36
Alternative analysis: Separate inclusion criteria for nest location points (e.g., all nests with 1994 activity field information). Buffers created but no removal of buffers due to habitat modification.	175	57	72	46

4. Stratified remaining nest location points into Northwestern California, Cascade and Modoc Jepson eco-regions (see Figure 1). Removed Warner Range nest location points from Modoc stratum (see Table 2 above). The Warner Range points appear geographically distinct (see Figure 1), and the habitat attributes

around these points are more similar to conditions for the Cascades stratum than to conditions for the other points from the Modoc stratum.

5. Drew 125-acre circular buffers around each remaining nest location point.

6. Compared 1990 & 1998 SPOT imagery and 1994 Landsat Imagery to determine if significant habitat modification occurred within buffers between 1989 and 1999. Removed nest location points/buffers if buffer habitat modification occurred during the four-year activity criterion time period, or if buffer habitat conditions during this period were suspected of differing significantly from the 1994 baseline imagery (see Table 2 above).

7. Used Fox (1997) Landsat imagery derived 1994 modified WHR 30-meter gird data to map habitat in the 117 remaining nest location buffers (see Figure 3). Used four progressively restrictive groups of the modified WHR classes to simplify habitat categorization (see Table 3 below).

8. Summed aggregate acres within buffers for the four WHR groups. Normalized sums by total buffer area to estimate percent coverage values for each WHR group. Calculated means, standard deviations, medians and percentiles and plot histograms for each strata (see Figures 4 – 6).

Table 3: Grouped WHR Classes Summed by Aggregate Area Within Buffers

WHR group	Canopy closure criterion	Size criterion	Included classes
4M+	> 40%	QMD: 11-24 in.	4M, 4D, 5M, 5D
4D+	> 60%	QMD: 11-24 in.	4D, 5D
5M+	> 40%	QMD: >24 in.	5M, 5D
5D+	> 60%	QMD: >24 in.	5D

9. Created three sets of randomly located contrast points within increasing distance ranges (e.g., 0.5 mile, 0.5-2.0 miles, 2.0-3.0 miles) from nest location points (see Table 4 below and Figure 2).

10. Drew 125-acre circular contrast buffers around each of the three sets of randomly located contrast points. Categorized habitat and calculated percent coverage values and statistics within these buffers as described in steps 7 and 8.

Table 4: Randomization of Contrast Buffers with Respect to Nest Location Buffers

	Random Contrast Points		Associated Buffers	
Buffer Type	radius randomization	angle randomization	radius range	angle range
Nest Location	n/a	n/a	[0.0 - 0.25 mile]	[0-360]
Contrast Set 1	[0.5 mile]	[0-360]	[0.25 - 0.75 mile]	[0-360]
Contrast Set 2	[0.5 – 2.0 miles]	[0-360]	[0.25 - 2.25 miles]	[0-360]
Contrast Set 3	[2.0 – 3.0 miles]	[0-360]	[1.75 - 3.25 miles]	[0-360]

11. Used two-tailed paired t-tests to identify statistically significant differences between nest location and contrast buffers in terms of WHR group percentage coverage values (see Table 5).

12. Alternative analysis: Used separate inclusion criteria for selecting nest location points from the Ncal-Gos database (e.g., Any nest with 1994 activity field information: 2Y, 3Y, 4Y, A, F1, F2, F3, NC, ND, NO1, NO2, NO3, OAU, ONB, ONB1, ONB2, ONB3, OU). Buffers created and stratified except that no check was made to remove buffers subject to habitat modification between 1989 and 1999. WHR values and statistics were calculated as described in steps 7 and 8. Two-tailed unequal variance t-test were used to identify statistically significant differences between nest location buffers for the two inclusion criteria methods (see Table 7).

References

Fox, L. G. L. Bonser, G. H. trehey, R. M. Buntz, C. E. Jacoby, A. P. Bartson and D. M. LaBrie. 1997. A Wildlife habitat map and database for the ORCA (Oregon-California) Klamath bioregion derived from Landsat imagery. Humboldt State University. Arcata, California.

Woodbridge, B. (data manager) 2001. NCal-gos. MS Access database (draft 12/2001). USFS-USFWS Northern Goshawk Program. Yreka, California